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SUBJECT III
FOOD AND NUTRITION SECURITY- FAILURE AND GOVERNANCE

Food Security in India: Trends, Patterns and Determinants

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I

INTRODUCTION

The concept of food security has evolved, developed, multiplied and diversified since the first World Food Conference of 1974. There are close to 200 different definitions of the term, but the essence of all these definitions is similar. The most common and useful definition of food security is "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Thus, the concept of food security, in its wider connotation has four dimensions – availability, accessibility, utilisation and vulnerability – the interactions among them determine how food secure a country is or how adequate, steady and risk-free food consumption is at the household and individual levels. Substantial progress has been made in reducing food insecurity in the four decades since the organisation of the first World Conference in 1974. But, maintaining food security at the national and household levels continues to be a major concern for India, both for the welfare of the people as well as for political stability. In order to improve food security, the Government of India has adopted a number of strategies which include concerted efforts to increase foodgrain production, intervention in the grain markets, institution of public distribution system and maintenance of stocks for major foodgrains. The promulgation of the National Food Security Act (NFSA) is in the offing to ensure economic and social access to adequate food and a living with dignity, for all persons in the country, at all times. However, in spite of several initiatives and strategies, the problems of food and nutritional security continue to persist in India. India is home to one-third of the world's undernourished children, almost half of the Indian children are stunted and 40 per cent are underweight; one-third of the Indian women are also underweight. And high rates of micro-nutrient deficiencies prevail across the board (Joshi *et al.*, 2011). At the same time, India is

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the second fastest growing economy in the world. The paradox of high economic growth and slow reduction in the number of food insecure persons needs to be understood in proper perspective. In this backdrop, the paper examines the performance, challenges and the underlying policies in food security in terms of three main pillars of food security, viz., availability, accessibility and absorption. Specifically the paper intends to examine the (i) progress in food supply in terms of availability at the national level; (ii) progress in terms of access to food and nutritional security at the household level; and (iii) assessment of programmes and policies being pursued for meeting food and nutritional security.

II

DATA

For the study, the household data on dietary pattern and consumer expenditures collected under major rounds of National Sample Survey (NSS) covering the years 1983, 1993-94, 2004-05 and 2009-10 pertaining to the 38th, 50th, 61st and 66th Rounds, respectively were used. These are national surveys with sample size of over 100,000 households (both rural and urban). The data refer to the average per capita consumption of all food and non-food commodities over a period of 30 days by a household. Data on the availability of food commodities, buffer stock and offtake were taken from the *Economic Survey* published by the Ministry of Finance, and *Agricultural Statistics at a Glance*, published by Ministry of Agriculture, Government of India, New Delhi.

The trends in food security have been analysed in terms of food availability, nutritional intake and incidence of nutritional deficiency. The role of policy in providing food security has been assessed by analysing the households' access to public distribution system (PDS) grain, and the extent of diversion of PDS grain. The determinants of nutritional intake have also been explored. The minimum (threshold) food-energy requirement has been taken as 1800 kcal/person/day for rural and 1575 kcal/person/day for urban households. It represented 75 per cent of the recommended values of 2400 kcal/person/day for rural and 2100 kcal/person/day for urban households (for more information, see Dandekar, 1996). An intake below this threshold was considered not sufficient for maintaining health and body weight and for carrying out light physical activity. The threshold level for food-protein intake was taken as 48 g/person/day and for fat as 16g/person/day for an average Indian The households consuming below this level were treated as malnourished. The trends have also been seen in nutritional intake and deficiency for poor and rich households. The bottom 30 per cent of the sample households, based on monthly per capita expenditure, were defined as poor households and the upper 30 per cent as rich households.

III

STAUS OF FOOD AND NUTRITIONAL SECURITY

Availability of Food

Improved high-yielding varieties of seeds, subsidised inputs, infrastructural developments, increased research and extension efforts, favourable agricultural price regimes accompanied by active government intervention in the foodgrain market and well-co-ordinated government programmes with able leadership ushered in Green Revolution in India during the 1960s. Adoption of these agricultural technologies and supporting price policies together helped in accelerating the production of foodgrains (especially of rice and wheat) in the country, enabling a hike in the per capita availability of food commodities (except pulses). Increase in the domestic production eliminated dependence on food import and India turned out to be a net exporter of foodgrains (Joshi *et al.*, 2009). However, in spite of impressive agricultural growth, the per capita availability of foodgrains hovered around 200 kg per annum between TE 1983-84 and TE 2009-10 and the availability of cereals has been around 185 kg per annum (Table 1). The increase in production has been much higher for horticultural, fish and livestock products than foodgrains. The per capita availability of non-foodgrains food commodities witnessed a considerable increase which helped in catering to the diversified food needs of the households. Despite much higher and much impressive growth in non-foodgrains food commodities, the popular opinion in the country appreciates green revolution only for its success in terms of increased food production. The remarkable achievement in the production of non-foodgrains food commodities such as fruit and vegetables, milk, eggs and fish needs adequate attention in the policy discourse.

TABLE 1. PER CAPITA PRODUCTION OR AVAILABILITY OF DIFFERENT FOOD COMMODITIES IN INDIA: 1983-84 TO 2009-10

(kg/annum)

Year (TE) (1)	Foodgrains (2)	Cereals (3)	Pulses (4)	Vegetables (5)	Fruits (6)	Milk (7)	Eggs (8)	Fish (9)
1983-84	198	181	17	56	31	52	17	35
1993-94	206	191	15	68	33	67	27	51
2004-05	184	172	12	86	45	84	39	59
2009-10	198	185	13	113	60	94	49	62

Source: *Agricultural Statistics at a Glance* (various years).

These trends suggest that India has not only achieved self-reliance in foodgrains production but often it is faced with the challenge of management of huge foodgrain surplus that accumulates as public buffer stocks.

Consumption of Food

The patterns of calorie as well as protein intake do not depict a clear trend for both rural and urban households. For the overall period from 1983 to 2009-10, the calorie and protein consumption has declined in the rural areas and increased in the urban areas (Table 2). The decline has been from 2240 kcal/capita/day to 2147 kcal/capita/day for calorie intake and also from 63.5 g/capita/day to 59 g/capita/day in protein intake in the rural areas. The per capita calorie intake in urban areas increased slightly from 2070 kcal/capita/day to 2123 kcal/capita/day and protein from 58.1 g/capita/day to 58.8 g/capita/day during this period. The consumption of fat consistently increased over time both in the rural and urban areas. The decline in calorie intake is attributed, by many scholars, to the declining requirements of energy, because of sedentary lifestyle, increasing mechanisation of agricultural operations and same domestic activities and increasing use of mechanised mode of transport, particularly in the rural areas (Radhakrishna and Reddy, 2004; Rao, 2003). However, these arguments seem to be misplaced at least on two counts. First, between 2004-05 and 2009-10 the per capita intake of calories increased in both rural and urban areas.

TABLE 2. TRENDS IN CONSUMPTION OF CALORIES, PROTEIN AND FATS BY RURAL AND URBAN HOUSEHOLDS IN INDIA: 1983 TO 2009-10

(per capita/day)

Year (TE)	Calories (kcal)		Protein (g)		Fats (g)	
	Rural	Urban	Rural	Urban	Rural	Urban
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1983-84	2240	2070	63.5	58.1	27.1	37.1
1987-88	2233	2095	63.2	58.6	28.3	39.3
1993-94	2153	2073	60.3	57.7	31.1	41.9
1999-00	2148	2155	59.1	58.4	36.0	49.6
2004-05	2047	2021	55.8	55.4	35.4	47.4
2009-10	2147	2123	59.3	58.8	43.1	53.0

Source: NSSO reports (various rounds).

Second, in the poor households, the consumption of calories increased marginally in both poor and rich households between 1983 and 2009-10; though it fluctuated in between (Table 3). In terms of income class, the difference in consumption of calories between poor and rich households is glaring. The per capita calorie consumption (1754 kcal/day) in the poor class is less than even two-thirds of the calorie intake by the rich class (2819 kcal/day). The level of calorie consumption for poor households is much below the prescribed norms. The consumption of protein and fat is also considerably lower in the poor than rich households. A wide difference in the levels of both protein and fat consumption continues to persist between the poor and rich households. Even the Indian Council of Medical Research (ICMR) has been reducing the norm of calorie intake for the Indian population over time. However, the existing consumption of calories may be adequate for certain section of

the populations, the low level of calorie intake for the poor population much below the RDA, is a matter of concern even though the calorie intake has shown an increasing trend in recent years (between 2004-05 and 2009-10).

TABLE 3. TRENDS IN CONSUMPTION OF CALORIE, PROTEIN AND FATS BY POOR AND RICH HOUSEHOLDS IN INDIA

(per capita/day)

	Calorie (kcal)		Protein (g)		Fat (g)	
Year (TE)	Poor	Rich	Poor	Rich	Poor	Rich
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1983	1698	2747	48	77	17	48
1987-88	1754	2791	50	80	19	52
1993-94	1544	2327	42	65	20	52
1999-00	1670	2756	45	73	22	71
2004-05	1757	2636	44	66	23	53
2009-10	1754	2819	48	85	29	71

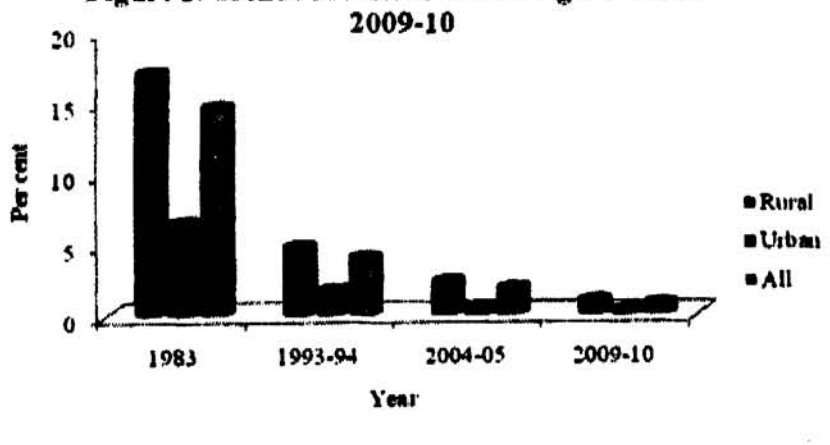
Source: The authors' estimates from various rounds of unit level NSSO data.

Absorption of Food

Hunger

A major impact of the increased food production, its better availability and favourable policies of the government has been the eradication of acute hunger to a large extent in India. According to the quinquennial surveys, the incidence of hunger has declined from 17.0 per cent in 1983 to mere about 1.0 per cent in 2009-10 in rural India and from 6.5 per cent to 0.3 per cent in urban India (Figure 1).

Figure 1: Trends in incidence of hunger : 1983 to 2009-10



It has also been observed that the regional disparity in the spread of hunger has considerably declined over the years (Table 4). The incidence of hunger in the eastern

states of Bihar, Odisha and West Bengal was 30 per cent or more in 1983, which has declined to 1.7-3.5 per cent in 2009-10. The south Indian states of Karnataka and Tamil Nadu have almost eradicated the incidence of hunger in 2009-10 from more than 15 per cent in 1983. Similarly, the incidence of hunger in Andhra Pradesh has declined from 12.3 per cent in 1983 to 0.40 per cent in 2009-10. Kerala, Maharashtra and Madhya Pradesh have also recorded similar achievements. In the western states of Punjab, Haryana, Gujarat and Rajasthan, the incidence of hunger was below 4 per cent even in 1983, which has declined to less than 0.5 per cent in 2009-10. However, concerns have been expressed on the reliability of the impressive decline in the incidence of acute hunger, which is based on the self-reporting by the household-head. Breadwinners' men often hesitate to admit that they are not capable of providing even two square meals a day to their dependents (Kundu, 2006). The issues of pride, self-respect and dignity constrain the heads of households to publicly admit their inability to provide food for their respective families.

TABLE 4. CHANGE IN INCIDENCE OF HUNGER IN DIFFERENT STATES OF INDIA[1]

(population in per cent)

States (1)	1983 (2)	2009-10 (3)	Decline between 1983and 2009-10 (4)
Andhra Pradesh	12.3	0.7	11.6
Assam	14.5	1.9	12.6
Bihar	31.2	2.3	28.8
Chhattisgarh	-	1.2	-
Gujarat	2.3	0.5	1.8
Haryana	1.1	0.5	0.6
Himachal Pradesh	3.3	1.6	1.7
Jammu and Kashmir	1.3	1.2	0.1
Jharkhand	-	0.2	-
Karnataka	15.6	0.2	15.4
Kerala	16.5	1.0	15.5
Madhya Pradesh	12.0	1.8	10.2
Maharashtra	10.5	0.4	10.1
Odisha	32.3	5.1	27.2
Punjab	1.9	0.4	1.5
Rajasthan	3.5	0.2	3.3
Tamil Nadu	14.4	0.0	14.4
Uttar Pradesh	9.1	0.7	8.4
Uttarakhand	-	0.5	-
West Bengal	29.6	5.4	24.2
All India	14.7	1.3	13.3

Source: Authors estimates based on unit level data from NSS on consumer expenditure for 38th and 66th Rounds.

1 Population who do not get two squares meal a day.

This may result in over-reporting of the number of meals family members are able to get (Saxena, 2011). Nevertheless, a significant decline in the incidence of acute hunger cannot be negated with even other available evidences.

Nutrition Deficiency

Apart from the incidence of hunger, the other important dimension of food security pertains to nutrition. Nutrition and physical consumption of food have several dimensions and depend upon a number of factors such as quality of water, sanitation, health and quality of food itself. It would be useful to look at the status of calorie, protein and fat deficiencies among various income classes of people in India. As seen from Table 5, nutritional deficiency as indicated by the percentage of population consuming less than 75 per cent of the prescribed norm of calorie intake continues to persist. One-fourth of the rural population and one-sixth of the urban population were undernourished in 2009-10. The incidence of energy deficiency was 32 per cent among rural and 27 per cent among urban population in 1983, it has declined to 24 per cent and 16 per cent respectively in 2009-10.The incidence of protein deficiency has declined from 29.6 per cent in 1983 to 25.6 per cent in 2009-10 among rural households and from 37.9 per cent to 29.8 per cent among urban households during this period. The incidence of fat deficiency has declined considerably in both rural and urban areas.

TABLE5. STATUS OF UNDER-NOURISHED POPULATION IN RURAL AND URBAN INDIA

(per cent)

	Rural			Urban		
NSSO Round (1)	Calories (2)	Protein (3)	Fat (4)	Calories (5)	Protein (6)	Fat (7)
1983	31.9	29.6	35.7	27.2	37.9	19.5
1987	26.6	24.8	26.2	19.5	29.2	11.7
1993	45.3	43.6	21.8	26.0	40.0	9.0
1999	31.5	33.8	18.6	18.2	33.0	5.7
2004	23.1	33.7	14.9	13.8	38.3	7.1
2009-10	24.3	25.6	7.3	16.0	29.8	4.6

Source: The authors estimates based on unit level data from NSS on consumer expenditure for 38th 43rd 50th, 55th, 61st and 66th Rounds.

The nutritional deficiency is concentrated mostly in the poor households. About 54 per cent of the poor households were deficient in energy intake in 1983, this percentage declined to 46.7 per cent in 2004-05 but has again increased to about 50.9 per cent in 2009-10 (Table 6). The continuance of energy deficiency among the poor households at such alarming rates year after year is a matter of concern. The incidence of energy deficiency in upper income households has been lower and is only 7.5 per cent in 2009-10. Although a similar pattern is seen in the case of protein deficiency, with a major difference that the incidence of protein deficiency among poor households has depicted an increasing trend, from 53 per cent in 1983 to 61.5 per cent in 2009-10.

TABLE 6. INCIDENCE OF NUTRITIONAL DEFICIENCY IN INDIA

(*per cent*)

Year	Calorie		Protein		Fat	
	Poor	Rich	Poor	Rich	Poor	Rich
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1983	53.8	8.7	53.0	11.7	52.2	7.5
1987-88	49.2	6.0	49.9	7.6	45.0	3.8
1993-94	64.0	17.8	66.7	21.0	38.6	3.1
1999-00	60.6	8.8	67.0	14.3	39.3	2.8
2004-05	46.7	5.7	67.5	15.4	28.4	4.5
2009-10	50.9	7.5	61.5	11.1	17.9	1.4

Source: The authors estimates based on unit level data from NSS on consumer expenditure for 38th, 43rd, 50th, 55th, 61st and 66th Rounds.

Across different states, the trends in the incidence of energy deficiency exhibit some contrasting patterns (Table 7). The incidence of energy deficiency has declined in almost all states with varying magnitude. However, a careful perusal of trends in calorie deficiency across states indicates that only the consumption of calories does not ensure the better health outcome. For instance, the deficiency in calorie consumption is less in Odisha than that in Kerala and Tamil Nadu. However, the health outcome indicators indicate that these are the states with low incidence of child malnutrition (NHFS, 2005-06). The similar trends were observed in the case of protein and fat. The incidence of under-nutrition in terms of calorie, protein though slowly declining is still alarmingly high.

TABLE 7. CHANGE IN UNDER-NOURISHED POPULATION IN DIFFERENT STATES OF INDIA: 1983 TO 2009-10

(*per cent*)

State	Calorie		Protein		Fat	
	1983	2009-10	1983	2009-10	1983	2009-10
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	32.2	19.8	48.1	33.6	34.5	1.6
Assam	32.6	19.9	47.4	34.8	50.0	12.0
Bihar	26.9	24.5	18.1	20.9	37.8	8.8
Gujarat	30.5	24.9	30.6	34.6	2.8	0.2
Haryana	18.7	16.0	12.0	14.3	3.4	0.2
Himachal Pradesh	16.2	8.0	10.8	7.4	2.1	0.1
Jammu and Kashmir	11.6	5.4	14.8	10.4	3.9	0.1
Karnataka	35.3	24.3	43.5	36.5	34.2	0.5
Kerala	62.1	32.0	66.7	38.2	63.6	5.5
Madhya Pradesh	23.2	28.5	15.9	25.2	17.6	3.1
Maharashtra	31.7	16.3	31.5	22.0	11.8	0.3
Odisha	30.1	17.7	43.0	33.7	68.7	17.5
Punjab	22.8	16.9	19.0	16.5	2.7	0.1
Rajasthan	16.5	15.0	10.3	10.0	5.3	0.1
Tamil Nadu	52.6	25.7	64.7	40.5	48.0	1.6
Uttar Pradesh	24.7	20.9	17.2	18.2	23.5	3.3
West Bengal	34.0	24.9	44.2	36.0	43.7	4.4
Jharkhand	37.6	26.6	38.4	33.3	48.5	10.0
Chhattisgarh	23.6	27.1	38.8	43.2	63.0	8.5
Uttarakhand	12.1	13.6	10.1	18.0	5.5	0.1
All India	30.3	21.1	32.5	27.2	30.0	6.2

Source: The authors estimates based on unit level data from NSS on consumer expenditure for 38th and 66th Rounds.

IV

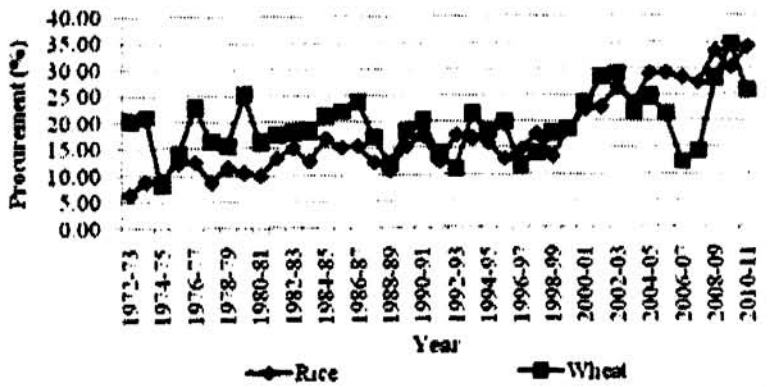
FOOD INTERVENTION PROGRAMMES AND POLICIES FOR FOOD SECURITY

The food intervention programmes in India have their origin in the West Bengal famine of 1943 and have evolved in the backdrop of repeated bouts of natural calamities (largely droughts and floods) and constant challenge of feeding a huge and rising population. A combination of both growth–led and support-led policies has been followed for improving the food security status in the country. Institution of a large public distribution system, combined with measures for controlling prices in the open market and concerted efforts towards achieving self-reliance in foodgrain production coupled with instruments for maximising procurement from the surplus areas, have been the main objectives of the food policy of India. These objectives have been in dominance for the past six decades, with changes on emphasis and focus. Currently, the food security system consist of three main instruments: minimum support/procurement prices, buffer stocks and the public distribution system. Besides, there are several poverty alleviation programmes, especially for the rural areas which also have explicit food security component. All these poverty alleviation and employment generation programmes aim at enhancing food-security status by strengthening the purchasing power of the poor households.

Procurement and Buffer Stock of Foodgrains

Price policy for agricultural commodities seeks to ensure remunerative prices to the farmers for their produce with a view to encouraging higher investment and production, and at the same time, safeguarding the interest of the consumers by making available supplies at reasonable prices. It has been observed that the procurement of rice and wheat has increased significantly over time and this increase has been not only in absolute terms but the intensity of procurement as a proportion of total production has also increased. Rice procurement as a proportion of total rice

Figure 2: Trends in rice and wheat procurement as percentage of production

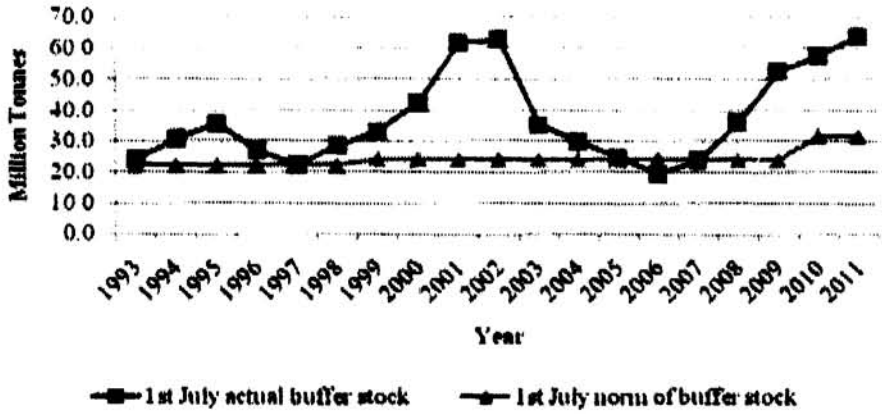


Sources: Department of Food and Public Distribution System, Government of India and *Agricultural Statistics at a Glance* (2011)

production in the country has increased from 6.4 per cent in 1972-73 to about 34 per cent in 2010-11 (Figure 2). The intensity of wheat procurement has also witnessed a similar trend. The intensity in the procurement of rice and wheat registered wide fluctuations especially before 1999-2000. In recent years, there has been a consistent rise in the procurement of foodgrains with the exception for wheat in 2006-07 and 2007-08.

Maintaining buffer stocks of two major food commodities, viz., rice and wheat, is another strategy adopted by the government. The actual level of and the norm for buffer stocks as on 1st July each year for the period from 1993-94 to 2009-10 is depicted in Figure 3. A continuous rise in procurement prices, coupled with the rise in issue prices and the obligation to purchase all grains offered by the farmers together could lead to accumulation of rice and wheat stocks to the extent of 63 million tonnes by July 2002. These stocks of 63 million tonnes were much above the optimal stocks of 24.3 million tonnes. The drought in 2003 caused a reduction in the food stocks which continued to decline till 2006. In fact, the actual buffer stocks in 2006 and 2007 were below the norm and the country had to import wheat during 2006-08. However, the foodgrain stocks accumulated once again in 2008 and 2009 and became higher than the norm. Presently, the government has more than 64 million tonnes of foodgrains in its stock, which is much in excess of the norm, and has high economic costs. Management of such huge stocks and avoiding wastage is a big challenge before the government. However, in view of the proposed enactment of National Food Security Act (NFSA), the higher stocks of foodgrains will have to be maintained and management strategies will have to be evolved.

Figure 3: Buffer stock of foodgrains: Rice and wheat: 1993-2011



Source: Department of Food and Public Distribution System, Govt. of India, New Delhi.

Public Distribution System

The institution of public distribution system (PDS) in the country is the most important intervention made by the Government of India, towards ensuring food security. Although the objectives and working of PDS have undergone significant

changes since its inception; it essentially continues to remain a food intervention programme. The Food Corporation of India procures foodgrains from the farmers at an administered price at harvest time and then ensures availability of these commodities to consumers at subsidised prices by allocating foodgrains to different states, who in turn manage their respective PDS. The proportion of foodgrains accessed through PDS in the total household consumption provides a glimpse of the role and effectiveness of PDS in ensuring food security in the country. It is evident from Table 8 that the role of PDS in meeting the consumption requirement of households has increased over time. The share of PDS in the total rice consumption in the country has increased from 9.9 per cent in 1993-94 to 21.7 per cent in 2009-10. Similarly, the share of PDS in wheat consumption was 12.7 per cent in 2009-10, up from 0.4 per cent in 1993-94. The share of PDS in the consumption of rice and wheat has depicted wide inter-state variations. The share of PDS in the consumption of rice has increased in all states, except in Gujarat, Haryana, Kerala, Punjab, Rajasthan and Uttarakhand. The share of PDS in wheat consumption has also depicted an increase in all the states, except Andhra Pradesh and Assam. The share of PDS in the total consumption of rice and wheat was higher in Andhra Pradesh, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Odisha and Tamil Nadu. In these states the PDS seems to be working well and households are taking advantage of this scheme.

TABLE 8. SHARE OF PDS IN RICE AND WHEAT CONSUMPTION IN DIFFERENT STATES OF INDIA: 1993-94 TO 2009-10

	Rice		Wheat		Rice and Wheat	
State	1993-1994	2009-2010	1993-1994	2009-2010	1993-1994	2009-2010
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	20.6	29.7	9.1	4.0	20.4	28.5
Assam	3.2	10.4	2.7	1.3	3.1	10.0
Bihar	0.2	4.7	0.3	4.8	0.3	4.7
Chhattisgarh	2.2	38.8	2.4	28.7	2.3	37.7
Gujarat	20.1	13.7	0.4	10.5	6.6	11.4
Haryana	4.3	0.5	0.0	12.4	0.4	11.4
Himachal Pradesh	32.5	43.3	0.3	44.3	12.3	43.9
Jammu & Kashmir	5.5	53.4	0.3	32.5	2.2	46.9
Jharkhand	0.3	12.7	1.9	15.4	0.7	13.5
Karnataka	14.5	34.5	1.4	26.1	12.5	32.9
Kerala	44.4	26.2	13.7	27.1	41.8	26.3
Madhya Pradesh	3.6	17.2	0.2	19.7	2.0	19.2
Maharashtra	13.4	22.4	0.3	21.4	7.2	21.8
Odisha	0.8	22.9	5.1	12.6	0.9	22.3
Punjab	2.3	0.1	0.1	12.7	0.3	11.5
Rajasthan	7.4	0.3	0.1	9.3	0.3	9.0
Tamil Nadu	17.9	47.6	2.8	51.8	17.1	47.9
Uttar Pradesh	3.2	16.1	0.0	6.8	0.9	10.0
Uttarakhand	45.9	19.6	0.2	13.2	20.6	16.0
West Bengal	1.7	5.3	2.0	28.3	1.7	8.3
All India	9.9	21.7	0.4	12.7	6.0	17.8

Source: Authors' estimates based on unit level data from NSS.

In some states like Assam, Bihar, Uttar Pradesh, PDS does not seem to have made much headway in improving the households' access to PDS grain. In general, the penetration of PDS has increased in almost all states of country over time and the share of PDS grain in household food consumption has increased. These findings suggest that the PDS has proved to be one of the most effective instruments of government policy over the years in stabilising the foodgrain prices and making their availability to the consumers at affordable price. It has been instrumental in averting widespread hunger and famine by supplying food from the surplus regions of the country to the deficit ones through market integration. The assured supply of foodgrains to rural areas has also contributed to crop diversification in the southern and western states as well as in the north-east region. Despite problems related to targeting, the system has been successful in reaching out to a large number of consumers, including the poor.

On the darker side, the PDS is facing criticism on several grounds and the major concerns are huge leakages and diversion of PDS grains. The large-scale diversion of grains from the PDS, in fact, has even jeopardised the effectiveness of the proposed National Food Security Act. There have been periodic estimations of the diversion of foodgrains from PDS to understand the dynamics of functioning of PDS and the effectiveness of initiatives taken from time to time to check the leakages of PDS grain (Government of India, 2002, 2005; Jha and Ramaswami, 2010; Himanshu and Sen, 2011; Khera, 2011a). The current discussion on diversion relies mainly on the data from the 61st round of the NSS or older data, besides individual perceptions. The latest calculations available are of Khera (2011a), who has used data till 2007-08. In the present study, the series of diversion estimates have been extended to 2009-10, the latest year for which data are available. The present assessment of the PDS, based on the latest data, assumes importance as state-level innovations in food policy have reinforced the trend towards a revival of the PDS in several states. The Ministry of Food and Consumer Affairs publishes monthly data on 'offtake' of wheat and rice under the PDS. The term 'offtake' refers to the actual amount delivered by the Food Corporation of India to state governments for the purpose of distribution through the PDS. The NSS provides information on the quantities of PDS wheat and rice, which are actually purchased by the households. Using NSS data on per capita monthly purchase of wheat and rice from the PDS, the aggregate purchase of PDS foodgrain in each state can be estimated. This total purchase by the consumers can be compared with the corresponding 'offtake' figure for that state. If there is no pilferage, the amount of purchase and 'offtake' should be the same. The difference between 'offtake' and purchase provides an estimate of the 'diversion' of PDS foodgrains to the open market. The estimated proportions of wheat and rice diverted in 1993-94 and 2009-10, are depicted in Table 9. A comparison of the performance of states reveals mixed trends. At the all-India level, the overall leakages from the PDS have declined from 47 per cent in 1993-94 to 39 per cent in 2009-10. Across grains the leakages of rice have increased from 18 per cent to 24 per cent and of wheat has

declined from 90 per cent to 58 per cent during this period. Though there has been a decline in the extent of leakages from PDS in most of the states, it continues to be alarmingly high in Assam (66.5 per cent), Bihar (70.0 per cent), Punjab (65.0 per cent), Rajasthan (65.7 per cent), Uttar Pradesh (57.9 per cent), Uttarakhand (53.6 per cent) and West Bengal (68.7 per cent). The diversion of PDS grain was observed to be nil in Chhattisgarh, Jammu and Kashmir and Tamil Nadu. The extent of leakages in Andhra Pradesh (9.9 per cent), Himachal Pradesh (19.0 per cent), Karnataka (20.8 per cent) and Kerala (24.4 per cent) was relatively less.

TABLE 9. EXTENT OF DIVERSION OF PDS GRAIN† : 1993-94 and 2009-10

(per cent)

State	Rice		Wheat		Rice and Wheat	
	1993-94	2009-10	1993-94	2009-10	1993-94	2009-10
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh*	13.8	9.7	-85.2	29.2	8.7	9.9
Assam	66.8	60.3	83.2	98.8	73.1	66.5
Bihar	79.3	71.7	97.6	67.8	94.6	70.0
Chhattisgarh*		-44.9		31.7		-33.0
Gujarat	-1.6	42.4	88.2	51.2	49.0	48.5
Haryana	52.9		99.4	35.7	91.2	35.5
Himachal Pradesh*	-4.7	15.9	99.5	20.9	56.0	19.0
Jammu and Kashmir*	70.4	-24.4	100.0	17.6	83.9	-12.0
Jharkhand		40.6		43.8		41.7
Karnataka	19.3	21.7	88.9	14.9	40.3	20.8
Kerala	5.8	19.3	96.4	47.2	20.9	24.4
Madhya Pradesh*	11.1	-26.4	80.1	50.1	50.0	43.7
Maharashtra	28.0	36.6	87.8	40.8	56.6	39.1
Odisha	76.1	14.6	93.9	86.1	85.8	27.4
Punjab	54.4		96.9	65.0	84.6	65.0
Rajasthan	33.1		99.9	65.7	97.9	65.7
Tamil Nadu*	-43.1	3.7	98.1	-57.7	-12.6	0.5
Uttar Pradesh	5.0	39.9	90.7	69.3	59.8	57.9
Uttarakhand	-	41.2		62.8	-	53.6
West Bengal	62.3	55.6	92.7	77.2	80.8	68.7
India	18.3	23.8	89.7	58.3	46.7	39.3

Source: The authors' estimates based on unit level data from NSS and Department of Food and Public Distribution System, Government of India, New Delhi.

†Proportion of grain 'offtake' from FCI.

*These states (possibly a few other also) augment centrally allocated grain through open market sales or open market purchase or "state pool" contributions. Using the allocation and offtake figures reported in the monthly food grains bulletins leads to underestimation of grain bulletin diversion. For accurate estimation, the grain allocated to the PDS by the state from local procurement and other sources should be added to the offtake figure. The lack of readily availability of data on contribution of state pool constrained further analysis in this article.

The experience of some states has shown that leakages can be plugged with proper management. Further, the level of diversion of rice is lower than that of wheat in most of the states. The possibilities of under-recording of PDS grain purchase in the NSS data have been expressed by few scholars (Deaton and Dreze, 2009; Khera, 2011a). The share of PDS in total consumption of rice and wheat was cross-checked with the data collected under the village level studies[1] conducted in the eastern India.

The evidence at the micro-level from three states, viz., Bihar, Jharkhand and Odisha, support the findings based on NSS data regarding the share of PDS in rice and wheat consumption (Table 10). The trends in diversion of PDS grain clearly point out the persistence of corruption in the PDS, which needed to be tackled to ensure the success of the proposed NFSA. The silver lining in bringing improvement in the functioning of PDS is apparent from the recent successes achieved in some states like Andhra Pradesh, Chhattisgarh, Haryana, Himachal Pradesh and Odisha. The strategies and approaches followed in these successful states should be vigorously pursued in other states.

TABLE 10. SHARE OF PDS IN TOTAL CONSUMPTION OF RICE AND WHEAT, 2011

(per cent)

Category	Bihar	Jharkhand	Odisha
(1)	(2)	(3)	(4)
Labour	17.9	28.2	34.9
Small farmers	8.0	34.6	35.0
Medium farmers	4.6	29.4	35.6
Large farmers	0.0	23.2	26.7
All	7.7	28.8	33.1

Source: Field survey, 2011.

V

DETERMINANTS OF FOOD SECURITY

Using a multivariate framework, the determinants of consumption of calories and protein were explored. The log-linear regression model was chosen based on the significance of regression coefficients and goodness of fit. The OLS regressions of per capita calorie and protein consumption, on the various socio-economic household characteristics are given in Table 11. The dependent variables were per capita calorie consumption and per capita protein consumption. The coefficients of regression equations indicate the importance of main factors affecting intakes of calories and protein at the household level. The ownership of land and monthly per capita expenditure (a proxy for household income) has positive and significant influence on per capita calorie and protein consumption. Income enhances the purchasing power of a household and thus increases the per capita nutritional intake. Ownership of land enhances the possibilities for home production and thus improves the nutritional intake. In India, the household-head being a dominant decision-maker influences the nutritional status of the household members. The response of per capita consumption of calorie and protein to the age of household-head was positive. This suggests that an older individual demands more health inputs and nutrition (Grossman, 1972). Higher levels of education appear to be inversely related with calorie consumption. This could be attributed mainly to two reasons. First, better educated individuals may have less energy-intensive occupations and therefore consume less. For instance,

educated persons are more likely to be either in regular employment or self-employed in soft business where one would expect lower levels of physical activity. Second, it is possible that education leads to diversification of diets away from cereals towards high-value foods such as vegetables, fruits, dairy products, meat, eggs, etc. The calorie consumption is observed to be negatively affected by female household-head and the gender of the household-head had no effect on protein consumption.

The most interesting findings emerged when the impact of PDS was seen on nutritional intake. The access to PDS boosts the per capita consumption of calories, but not the consumption of protein. This suggests that access to PDS improves cereal consumption due to easy availability of cereals for households' consumption. Cereals are still the major source of calorie intake for the majority of the households and the access to PDS increases its consumption, which in turn enhances the per capita calorie intake. Khera (2011 b) has also observed that the access to PDS increases wheat consumption by the households. Large household size appears to result in lower per capita consumption of calorie as well as of protein. If the household size was larger, the probability of it being a joint-family was higher and in that case, the household-head would be the main decision-maker who may not allow the household members to satisfy hunger first (to the extent possible within a given household budget constraint) before satisfying other wants (Bouis *et al.*, 1998). Sinha (2005) has also reported the negative effect of household size on calorie consumption for the average Indian households. However, this has to be carefully interpreted. The lower consumption in bigger households may also potentially be due to economies of scale in food preparation and consumption. In larger families there is often less food waste than in smaller ones. Therefore, the lower average calorie intake does not invariably mean actual lower calorie intake. The social group captures the effect of household's social background on nutritional intake. The results indicate that belonging to an upper caste reduced the demand for calorie consumption. This is plausible as majority of the households in weaker sections (SCs, STs and OBCs) are more likely to be engaged in physical activity and their nutritional requirements would be higher.

The effect of prices theoretically should be such that own price effects are negative and cross price effects are positive. Since there is no clear price of calories to account for the price effect, we have taken the price of major food commodities. The effect of price of wheat, pulses and milk was observed to be negative and significant on the consumption of both calorie and protein. The price of rice had a significant negative influence on calorie consumption but its effects on protein consumption were not significant. The occupation type of the household can also affect calorie and protein demand. A household belonging to agricultural labourer or other labourer or self-employed in agriculture rather than belonging to self-employed in non-agriculture had a positive effect on the consumption of calorie and protein. The regression coefficients for regional dummies exhibited mixed results.

TABLE 11. DETERMINANTS OF NUTRITIONAL INTAKE IN INDIA: 2009-10

	Dependent variable: Per capita per day calorie consumption		Dependent variable: Per capita per day protein consumption	
	Calorie		Protein	
(1)	Rural (2)	Urban (3)	Rural (4)	Urban (5)
Age (years)	0.0015***	0.0020***	0.0016***	0.0021***
	(7.46)	(9.09)	(7.31)	(8.93)
Household headed by (Female - 1,	-0.024***	-0.0123**	0.0044	0.0095
otherwise - 0)	(-4.54)	(-2.02)	(0.79)	(1.49)
Education (years)	-0.0001*	0.0016	0.0009	0.0025**
	(-0.08)	(1.36)	(0.98)	(1.99)
Social group (SC and ST - 1,	0.0065**	0.0101**	-0.0090***	0.0007***
otherwise - 0)	(1.98)	(2.42)	(-13.00)	(-12.74)
Family size (No.)	-0.0287***	-0.0442***	-0.0273***	-0.0423
	(-14.39)	(-14.49)	(-2.92)	(0.19)
Operated land (ha)	0.0110***	0.0166***	0.0127**	0.0178
	(10.13)	(6.97)	(2.22)	(-1.48)
Monthly per capita expenditure (Rs.)	0.0001***	0.0000***	0.0001***	0.0000***
	(5.05)	(2.92)	(11.12)	(7.44)
PDS consumption (yes - 1,	0.0255***	0.0072*	0.0071***	-0.0060***
otherwise - 0)	(7.47)	(1.71)	(5.08)	(3.00)
Price of rice (Rs./kg)	-0.0012*	0.0000	0.0005	0.0008
	(-1.72)	(0.02)	(0.64)	(0.78)
Price of wheat (Rs./kg)	-0.0002	-0.0002***	-0.0007***	-0.0003***
	(-1.07)	(-3.2)	(-3.75)	(-4.72)
Price of pulses (Rs./kg)	-0.0005***	-0.0008***	-0.0011***	-0.0011***
	(-4.34)	(-4.27)	(-9.40)	(-5.66)
Price of milk (Rs./kg)	-0.0017***	0.0000***	-0.0022***	0.0000***
	(-7.68)	(-2.87)	(-9.70)	(-4.44)
Region (Eastern - 1, otherwise - 0)	-0.0721***	-0.1061***	-0.1083***	-0.1064***
	(-6.33)	(-12.44)	(-9.17)	(-12.42)
Region (Western - 1, otherwise - 0)	-0.0989***	-0.1168***	-0.1047***	-0.1200***
	(-9.70)	(-13.69)	(-9.94)	(-13.96)
Region (Northern - 1, otherwise - 0)	-0.0592***	-0.0967***	-0.0300***	-0.0655***
	(-7.38)	(-11.90)	(-3.74)	(-8.19)
Region (Southern - 1, otherwise - 0)	-0.1567***	-0.1232***	-0.2289***	-0.1676***
	(-25.91)	(-17.79)	(-39.56)	(-24.89)
Region (North east - 1, otherwise - 0)	-0.0707***	-0.0848***	-0.1186***	-0.1081***
	(-8.10)	(-9.56)	(-14.46)	(-12.32)
Occupation (self-employed in non-	-	-0.0584	-	-0.0899
agriculture - 1, otherwise - 0)		(-0.87)		(-0.90)
Occupation (agricultural labour - 1,	-0.0207***	-	-0.0234***	-
otherwise - 0)	(-4.08)		(-4.94)	
Occupation (other labour - 1,	0.0188***	-0.0786	0.0213***	-0.0623
otherwise - 0)	(5.81)	(-1.16)	(6.87)	(-1.29)
Occupation (regular salaried/wage	-	-0.0645	-	-0.0749
earning - 1, otherwise - 0)		(-0.96)		(-1.08)
Constant	7.8103***	7.9151***	4.2003***	4.2798***
	(548.57)	(115.25)	(297.74)	(60.68)

Note: ***, ** and * significant at 1, 5 and 10 per cent level, respectively.

In the case of protein consumption, the households belonging to the northern region increased the demand for protein consumption in comparison to the households belonging to the hill region. The households belonging to the eastern,

western and southern regions have a lower demand for protein than the households located in the hill region. In the case of calorie intake, the households belonging to western, southern and north-eastern regions have lower demand for calorie-intake as compared to the households belonging to the hill region.

VI

CONCLUSIONS AND POLICY IMPLICATIONS

The study has examined the trends in on food security in India with the latest available evidences in terms of availability, access and absorption, and has observed that all these dimensions are inter-related. The findings has also shed light on food management policies and their impact on food security. Several interesting findings have emerged and the important among them are outlined below: (i) 'Availability' is a necessary condition for food security. Though per capita availability of foodgrains is hovering around 200 kg per annum, the availability of non-foodgrain food commodities has depicted an impressive trend. (ii) The consumption of calorie has revealed a sustained decline since 1983 which continued till 2004-05. There is a strong evidence of reversal in the declining trend of calorie consumption in 2009-10. Between 2004-05 and 2009-10, the consumption of calorie both in the rural and urban areas, has increased by about 5 per cent, though it is still lower than the level of 1983. (iii) Reversal of the trend is not limited to calories; it applies to consumption of proteins and fat also. However, wide differences continue to persist in the intake of calorie and protein across states, locations (rural and urban) and income classes (poor and rich). (iv) Though self-reported hunger has almost vanished in most of the states, the nutritional deficiency continues to persist across states as a rule rather than exception. It is highly concentrated among poor households. (v) Utilisation of PDS has improved overtime though the picture is still not very bright. The evidence of diversion of PDS grain is mind-boggling, though it has shown a declining trend. Some of the states have performed well in PDS management in recent years. (vi) The consumption of calories and protein is determined by a number of socio-economic characteristics of a household. The effect of age, land ownership, income, and access to PDS has positive and significant influence on consumption of calorie and protein. The family size and price of major foodgrains are inversely related to the level of calorie and protein consumption. The effect of education on nutritional intake is observed to be mixed. The prices of major food commodities have a negative influence on the nutritional intake.

These conclusions have some important implications for the food policies to ensure food security in India. The persistence of nutritional deficiency suggests the need to vigorous pursue the long-term strategies for augmenting food production, especially through enhancement in productivity. Streamlining and tightening of the food distribution system is equally important. There is a need for further research to understand the consistently poor performance of PDS in some states and reasons

behind improvement in others. The future of the NFSA depends a great deal on the success of the PDS across the country.

The positive relationship between household income and nutritional intake suggests that the anti-poverty programmes should be continued, broadened and enhanced to achieve the desired outcome. Besides, increasing the efficiency of public expenditure and strengthening of social safety net programmes (like MNREGS, ICDS, NFSM, Mid-Day Meal, PDS, etc.) must be accorded high priority in the future planning process of the country. The lessons learnt from the successful states in PDS management should be replicated in poor-performing states. An alternative system of PDS can also be explored in these states.

NOTE

1. An ICAR-ICRISAT collaborative project supported by Bill and Melinda Gates Foundation is being pursued and data are being collected by the resident field investigator on a continuous basis from the sample households and thus the quality of data is, by and large, ensured.

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